

10/ 50/ 910  
7-20-04

BEST AVAILABLE COPY

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
7 August 2003 (07.08.2003)

PCT

(10) International Publication Number  
**WO 03/064756 A1**

(51) International Patent Classification<sup>7</sup>: D06N 7/00, 3/00

Jugong-APT, Wonmun2-dong, Kuacheon-si, Kyunggi-do 427-030 (KR).

(21) International Application Number: PCT/KR03/00204

(22) International Filing Date: 29 January 2003 (29.01.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
10-2002-0005813 1 February 2002 (01.02.2002) KR

(71) Applicant (for all designated States except US): KOLON INDUSTRIES, INC [KR/KR]; Kolon Tower, 1-23, Byulyang-dong, Kwacheon-si, Kyunggi-do 427-040 (KR).

(74) Agent: CHO, Hwal-Rai; Suite No. 1507 Yoksam Heights Bldg, 642-19, Yoksam-dong, Kangnam-gu, Seoul 135-981 (KR).

(81) Designated States (national): AE, AG, AL, AM, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CN, CO, CR, CU, CZ, DM, DZ, EC, EE, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KZ, LC, LK, LR, LS, LT, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, RO, RU, SC, SD, SG, SK, SL, TJ, TM, TN, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR).

(72) Inventors; and

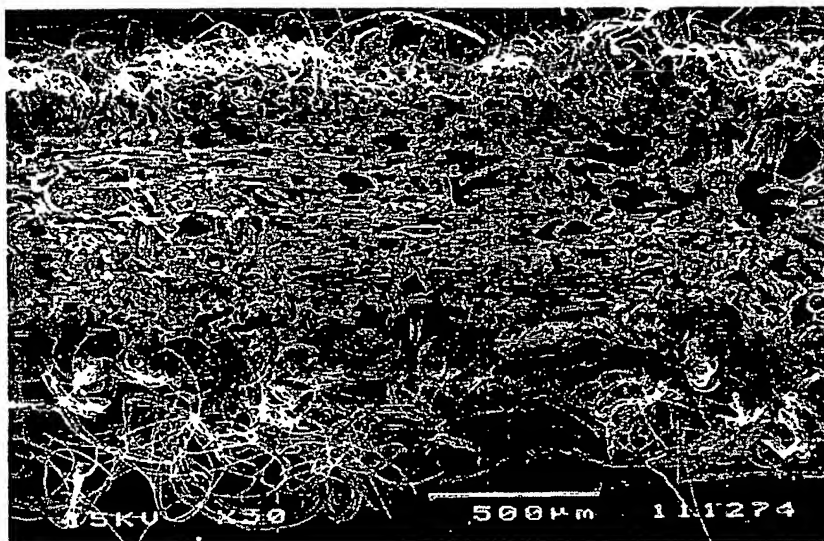
(75) Inventors/Applicants (for US only): HWANG, Young-Nam [KR/KR]; 107-502. Wobang Shinseki town, Sangmo-dong, Gumi-si, Kyungsangbuk-do 730-090 (KR). KIM, Won-Jun [KR/KR]; 204/304 Pung-lim APT, 151-10 Hyunggok-dong, Gumi-si, Kyungsangbuk-do 730-040 (KR). CHUNG, Jae-Hoon [KR/KR]; 204-110

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A COMPOSITE SHEET USED FOR ARTIFICIAL LEATHER WITH LOW ELONGATION AND EXCELLENT SOFTNESS



(57) Abstract: The present invention relates to a composite sheet used for artificial leather with low elongation and excellent softness. The composite sheet for artificial leather comprises: a non-woven fabric layer (1) made of ultra fine fibers having a fineness less than 0.3 denier; a woven or knitted fabric layer (2) constructed from a yarn made of ultra fine fibers having a fineness less than 0.3 denier; and polyurethane resin, wherein the ultra fine fibers of the non-woven fabric layer (1) and the ultra fine fibers of the woven or knitted fabric layer (2) are entangled with each other. The composite sheet of the present invention has a stitching strength of more than 30kg/mm, an elongation at constant load of less than 20 % and a stiffness of less than 80mm. Since

the composite sheet for artificial leather of the present invention is excellent in both form-stability and softness, it is useful for the production of artificial leather for furniture, cars, men's clothing and sundry goods.

WO 03/064756 A1

## A COMPOSITE SHEET USED FOR ARTIFICIAL LEATHER WITH LOW ELONGATION AND EXCELLENT SOFTNESS

### TECHNICAL FIELD

5       The present invention relates to a composite sheet used for artificial leather with low elongation and excellent softness. More particularly, the present invention relates to a composite sheet used for artificial leather which is useful for the production of artificial leather for furniture, cars, men's clothing and sundry goods because  
10 it has an excellent form-stability and a soft touch.

      An artificial leather is generally produced by coating resin on the surface of a sheet for artificial leather consisting of two components, i.e., non-woven fabric made of ultra fine fibers and polyurethane resin according to its uses or directly dyeing the  
15 surface.

      The above-mentioned sheet for artificial leather is produced by a method comprising the steps of: (i) forming a composite fiber capable of becoming fine into a web by a carding-cross lapping process; (ii) needle-punching the web to form a non-woven fabric;  
20 (iii) making the fiber ultra fine by impregnating the non-woven fabric with polyurethane resin and extracting and removing the sea component of the composite fiber or by firstly extracting and removing the sea component of the composite fiber and then impregnating the non-woven fabric with polyurethane resin; and (iv)

buffing the fabric to form raised fibers on the surface.

### BACKGROUND ART

An artificial leather produced by the conventional production  
5 method, i.e., suitable for a common artificial leather sheet, is widely  
used for clothing, shoes, gloves and the like because it has a superior  
appearance and touch. However, it is inferior in strength and had too  
high an elongation. This makes it difficult to apply the sheet to  
covering for furniture, cover sheet for car chair, men's clothing and  
10 the like which require a form-stability.

To solve such a problem, there was proposed a method for  
improving form-stability by increasing the amount of polyurethane  
resin to be impregnated when producing the sheet for artificial  
leather. In this case, the artificial leather has an excellent  
15 form-stability but low in softness and there is a risk that the  
appearance of the artificial leather is spoiled.

There was an attempt to decrease the amount of polyurethane  
resin to be impregnated to thus improve the appearance and touch of  
the product when producing the sheet for artificial leather. In this  
20 case, however, the form-stability of the artificial leather was  
degraded.

Japanese Patent Laid-Open No. S62-78281 and U.S. Patent No.  
5,256,429 disclose a composite sheet for artificial leather which is  
produced by inserting a layer of fabrics woven from a yarn having

more than 1 denier into a non-woven fabric layer of an ultra fine fiber as a reinforcing material, needle-punching them and physically coupling the ultra fine fiber of the non-woven fabric layer and the yarns of the layer of the fabrics.

5           This method can improve the form-stability of the artificial leather but there is a problem that the fibers of the layer of the fabrics for reinforcement which has a much large denier than the ultra fine fiber are raised and protruded to the surface of the composite sheet, thus making the touch of the artificial leather  
10   rough and hard. Additionally, when performing dyeing, there occurs a difference in dyeing concentration due to a difference in denier between the ultra fine fiber protruded to the surface and the thick fiber of the layer of the fabrics for reinforcement, thereby degrading the appearance of the product.

15           As seen from the conventional art, a composite sheet for artificial leather capable of improving the form-stability and touch of the artificial leather has not been developed yet.

#### DISCLOSURE OF INVENTION

20           It is an object of the present invention to provide a composite sheet used for artificial leather which is very useful for the production of artificial leather for furniture, cars, men's clothing and sundry goods because it has excellent form-stability and softness.

          The present invention provides a composite sheet for artificial

leather which has excellent form-stability and softness so that it is suitable for the production of artificial leather for furniture, cars, men's clothing and sundry goods. For this, the present invention provides a composite sheet for artificial leather which has excellent  
5 elongation and softness which has a stitching strength of more than 30kg/mm, an elongation at constant load of less than 20% and a stiffness of less than 80mm by inserting a woven or knitted fabric constructed from a yarn made of ultra fine fibers having a monofilament denier of less than 0.3 into a common sheet for  
10 artificial leather composed of a non-woven fabric layer made of ultra fine fiber and polyurethane resin and needle-punching them.

To achieve the above object, there is provided a composite sheet for artificial leather according to the present invention, comprising: a non-woven fabric layer(1) made of ultra fine fibers  
15 having a fineness less than 0.3 denier; a woven or knitted fabric layer(2) constructed from a yarn made of ultra fine fibers having a fineness less than 0.3 denier; and polyurethane resin, wherein the ultra fine fibers of the non-woven fabric layer(1) and the ultra fine fibers of the woven or knitted fabric layer(2) are entangled with each  
20 other.

Additionally, there is provided a composite sheet for artificial leather according to the present invention, comprising: a non-woven fabric layer(1) made of ultra fine fibers; a woven or knitted fabric layer(2) constructed made of ultra fine fibers; and polyurethane resin,

wherein the ultra fine fibers of the non-woven fabric layer(1) and the ultra fine fibers of the woven or knitted fabric are entangled with each other and the fineness of the ultra fine fibers of the woven or knitted fabric layer(2) is not more than the fineness of the ultra fine fibers of the non-woven fabric layer(1).

Additionally, there is provided a composite sheet for artificial leather according to the present invention, comprising: a non-woven fabric layer(1) made of ultra fine fibers; a woven or knitted fabric layer(2) made of ultra fine fibers; and polyurethane resin, wherein the ultra fine fibers of the non-woven fabric layer(1) and the ultra fine fibers of the woven or knitted fabric layer(2) are entangled with each other and the composite sheet has a stitching strength of more than 30kg/mm, an elongation at constant load of less than 20% and a stiffness of less than 80mm.

Hereinafter, the present invention will now be described in detail.

Firstly, ultra fine fibers which are employable in the present invention are made by conjugate-spinning or mix-spinning two kinds of fiber forming polymer materials into a sea-island type or division type, or by ordinary-spinning a fiber forming polymer materials to a fineness less than 0.3 denier.

In case of the sea-island type, for the island component, polyester based polymer or nylon based polymer can be used and, for the sea component, copolymer polyester, polyethylene, polyvinyl

alcohol, polystyrene and the like which has a solubility in a particular solvent different than that of the island component can be used.

In case of the division type, polyester, nylon and copolymer polyester can be used, which are capable of dividing the ultra fine  
5 fibers by extracting or removing one component from two kinds of polymers with a solvent such as sodium hydroxide.

The ultra fine fiber employed in the present invention is formed in two kinds of sheet (layer) form in the composite sheet for artificial leather: one is a staple non-woven fabric layer(1) form and the other  
10 is a woven or knitted fabric layer(2) form.

The staple non-woven fabric layer(1) can be made by cutting a yarn(filament) capable of being fine to a fineness less than 0.3 denier into short fibers, then forming a web through a carding-cross lapping process and then needle-punching the same.

15 The woven or knitted fabric layer(2) can be made by weaving or knitting with a spun yarn, which is made by carrying out a carding-slivering-twisting process on short fibers(staple) prepared by cutting a yarn(filament) capable of being fine to a fineness less than 0.3 denier, or by weaving or knitting with a continuous filament,  
20 which is produced by spin-draw process, through a twisting process. That is, the woven or knitted fabric layer(2) constructed of ultra fine fibers used in the present invention can be woven or knitted from a spun yarn made of staple or continuous filament yarn.

The ultra fine fibers used in the present invention preferably

have a fineness less than 0.3 denier after a fiber fining treatment. In a case that the fineness of the ultra fine fibers is more than 0.3 denier, it is difficult to obtain artificial leather with a soft touch.

Additionally, the yarn constituting the woven or knitted fabric layer(2) in the present invention is more preferably constructed of ultra fine fibers having a fineness of 0.01 to 0.3 denier. Larger fineness may cause damage of the woven or knitted fabric due to a needle-punching operation for bonding the woven or knitted fabric(2) to the staple non-woven fabric layer(1) and the damaged fibers often come out to the surface of the artificial leather. Thusly, since the fibers of the woven or knitted fabric layer(2) which come out to the surface has a larger fineness than that of the staple fibers of the non-woven fabric layer(1), this brings about uneven appearance of the artificial leather and lower softness. Moreover, since the color of the artificial leather is changed a lot according to a fineness of fibers after dyeing, the fibers of the woven or knitted fabric layer(2) exposed to the surface is shown to be a conspicuous defect. Furthermore, since a large fineness of fibers can make the touch of the woven or knitted fabric layer(2) excessively hard, this can spoil the softness of the artificial leather.

The present invention does not specially limit the lowest value of the denier of the ultra fine fibers constituting the woven or knitted fabric layer(2). However, in case that the yarn constructed of excessively fine fibers is used for the production of the woven or



knitted fabric layer(2), it is difficult to uniformly control the fineness of the ultra fine fibers, the degree of elongation is increased during the process after removing the sea component and the physical properties of the final product, such as strength, elongation and the like, is largely decreased, thereby reducing the effect of improving the form-stability. Therefore, the fineness of the ultra fine fibers is more preferably more than 0.01 denier and less than 0.3 denier.

Additionally, in the present invention, the total denier of the yarn constituting the woven or knitted fabric layer(2) is preferably 30 to 150 denier. Smaller fineness can cause a decrease in physical properties such as strength, elongation and the like, which may bring about a decrease of the form stability. On the other hand, larger fineness can make the woven or knitted fabric layer(2) excessively hard, and thusly it is difficult to obtain a desirable softness and flexibility for artificial leather even if it becomes ultra fine after dissolution.

In the present invention, the yarn constituting the woven or knitted fabric layer(2) is preferably constructed of 200 to 10,000 ultra fine fibers. After a fiber fining treatment, if the number of the ultra fine fibers existing in one strand of the yarn is more than 10,000, the fibers becomes excessively fine or the total denier is increased. This eliminates the effect of improving the form stability or increases the risk of losing the softness of the artificial leather, which is not preferable.

In contrast, if the number of the fibers existing in one strand of the yarn is less than 200 after the fiber fining treatment, the fibers becomes excessively thick or the total denier is decreased. This eliminates the softness or increase the risk of reducing the physical properties such as strength, elongation and the like, which is not preferable.

Moreover, in the present invention, the yarn constituting the woven or knitted fabric layer(2) is preferably a twisted yarn having a number of twists of 500 to 4000 twist/meter (hereinafter, shown as t/m). If the number of twists is 500 to 700 t/m, the form-stability is at an average level but the softness is very excellent. So such a yarn is suitable for artificial leather such as clothing or the like which requires a soft touch.

Further, if the number of twists is 700 to 2,500 t/m, the yarn has a low elongation and good softness, it is suitable for covering for furniture which requires form-stability. On the other hand, if the number of twists is high, that is, 2,500 to 4,000 t/m, the yarn is more suitable for artificial leather such as cover sheet for car chairs which require wear resistance and form-stability.

In case that the woven or knitted fabric layer(2) is a woven fabric, the densities of the warp and weft are more than 40 yarns/inch, more preferably, more than 60 yarns/inch. The weight of the knitted fabric is preferably 30 to 200g/m<sup>2</sup>.

The composite sheet which comprises the non-woven fabric

layer(1) of the ultra fine fibers combined to the woven or knitted fabric layer(2) can be made by various methods. The most common method is a needle-punching method wherein one or more staple non-woven fabric layers and woven or knitted fabric sheets are alternately arranged and are entangled by needle-punching when making a non-woven fabric.

In another method, a woven or knitted fabric sheet of ultra fine fibers can be bonded with a intermediate product having a non-woven fabric of ultra fine fibers filled with polyurethane resin using an adhesive, or a woven or knitted fabric sheet of ultra fine fibers can be boned with the product of which a series of artificial leather treatment such as buffing or dyeing has been finished.

A 3 to 15% concentration water soluble polymer solution of polyvinyl alcohol or carboxylmethyl cellulose is padded and dried on the composite sheet of the non-woven fabric and the woven or knitted fabric so as to have the amount of 5 to 20% by weight with respect to the weight of the fibers. This process is effective for preventing the touch of the final product from being hard with the polyurethane resin being excessively boned with the fibers converted into a bundle of fine fibers in the later process of impregnating polyurethane resin.

Next, a polyurethane wet impregnating treatment is carried out on the composite sheet. The polyurethane elastomer used in this step is easily dissolved in a straight-chained polymer material consisting of

macroglycol, diisocyanate and a low molecular weight diol or diamine, or in some crosslinking polymer materials such as dimethylformamide (hereinafter, refer to as "DMF").

The macroglycol used in the present invention may include  
5 polyether glycol, polyester glycol, polyether polyester copolymer glycol, polycarbonate glycol and the like. The low molecular weight diols in the present invention may include 4,4'-butandiol, ethylene glycol and the like. It also may use a chain extender of diamine base such as methylene-bis-(4,4'-phenylamine).

10 An impregnating solution is made by adding a detergent, pigments, functional particles and the like to such a DMF solution of polyurethane elastomer and diluting the resulting solution. The composite sheet is dipped in the impregnating solution, coagulated in an aqueous solution, washed in hot water at 50 to 80°C for  
15 completely removing temporary filled water soluble polymer, and then dried. The content of the polyurethane after drying is preferably 20 to 50% by weight with respect to the weight of the composite sheet.

Continuously, the fibers are converted into a bundle of fine  
20 fibers by removing the sea component from the fiber constituting the non-woven fabric layer(1) and the woven or knitted fabric layer(2) with a solvent or aqueous solution of sodium hydroxide which is capable of dissolving the sea-component. The sea component exists in both fibers of the non-woven fabric layer(1) and fibers of the

woven or knitted fabric layer(2). If their types of the sea component are different, fiber fining treatment has to be performed to each of them, which makes the treatment complicated.

Therefore, in the present invention, it is more preferable that  
5 the fiber fining treatment is simultaneously attained by only one dissolution process by making the fibers of the non-woven fabric layer(1) and the fibers of the woven or knitted fabric layer(2) from the same type of the sea component.

In case that the sea component is a copolymerized polyester,  
10 the sea component is decomposed by a continuous or discontinuous arrangement method with a 5 to 15% aqueous solution of sodium hydroxide. In case that the sea component is polyethylene or polystyrene, the sea component is removed by treating with toluene, perchloroethylene or trichloroethylene.

15 For example, the copolymerized polyester of the sea component is completely decomposed and removed by treating with a 10% aqueous solution of sodium hydroxide at 100°C for 5 to 10 minutes. At this time, although the fineness of the composite sheet constructed of the non-woven fabric layer(1) and the woven or  
20 knitted fabric layer(2) is decreased to some degree because their sea component is simultaneously removed, the form of the composite sheet is kept well by the structure of the woven or knitted fabric, the degree of longitudinal elongation caused by a mechanical tensile force is not large and the apparent density of the surface of the composite

sheet is improved.

As seen from the above method, in general, the sea component is dissolved after impregnating with polyurethane. This is referred to as post dissolution. On the contrary, the sea component can be dissolved before impregnating with polyurethane. This is referred to as pre-dissolution. This method is applied for the purpose of improving the appearance and physical properties of the artificial leather after the fiber fining treatment

Next, the surface of the thusly obtained composite sheet of the leather form is buffed by a buffing machine equipped with a sand paper of a proper roughness to thus form raised fibers on the surface and then fluffs are shagged. The roughness of the sand paper is differently selected according to its use. Typically, it is preferable to use the sand paper of 150 to 400 meshes.

The composite sheet for artificial leather with fluffs has the following characteristics from a macrostructural viewpoint. Firstly, on the surface formed with the fluffs, there are a small number of filament fibers or spun fibers of the woven or knitted fabric layer(2) broken during needle-punching and protruded to the surface. Even if there are some fibers of the woven or knitted fabric layer(2) protruded to the surface, the fineness is not more than that of the fibers of the non-woven fabric layer(1).

In case that the fibers of the woven or knitted fabric layer(2) protruded to the surface have a larger fineness than a monofilament

of the non-woven fabric layer(1), this becomes more apparent after dyeing and their modulus also becomes larger, thereby greatly degrading the appearance and touch of the surface.

Additionally, in the composite sheet for artificial leather of the present invention, the weight ratio of the non-woven fabric layer(1)/woven or knitted fabric layer(2) is 90:10 to 50:50. Thus, it is preferable that the weight of the non-woven fabric layer(1) is not less than that of the woven or knitted fabric layer(2).

Moreover, in the composite sheet for artificial leather of the present invention, the weight ratio of the ultra fine fibers/polyurethane resin is 90:10 to 50:50. Thus, it is preferable that the amount of the ultra fine fibers constituting the non-woven fabric layer(1) and the woven or knitted fabric layer(2) is not less than that of the polyurethane resin.

The composite sheet for artificial leather having the above-mentioned structural characteristics is finally treated according to its use. Generally, the composite sheet is made into an artificial leather of suede type by a dyeing treatment, or is made into an artificial leather of mirror-like type by forming a polyurethane coating layer on the surface.

In case that the composite sheet for artificial leather of the present invention is the suede type, the ultra fine fibers located on the surface has a raised structure.

When directly performing dyeing, in case that the used fiber

comprises nylon-6, it is typically dyed with a metal complex dye or milling type acid dye. In case of polyester, it is dyed with a disperse dye in a high pressure rapid dyeing machine. Finally, when a softening and functional agent treatment is carried out on the dyed product, a composite suede-like artificial leather with excellent surface effect, superior form-stability and softness is made.

In contrast, in case of making an artificial leather of mirror-like type with soft surface, no dyeing is performed on the basic fabric with raised fibers, but polyurethane coating is performed on raised fibers using a typical coating machine for artificial leather. The polyurethane elastomer used in the above coating process is polyurethane for artificial leather having 20 to 30% solid matter. The coating method includes dry or wet coating treatment, if required, laminating treatment.

By the above-mentioned procedure and method, it is possible to make a composite sheet for artificial leather with superior form-stability and soft touch, i.e., low elongation and excellent softness, and an artificial leather using the same.

As described above, in order to make the composite fiber for artificial leather of the present invention, generally, the woven or knitted fabric sheet made of ultra fine fibers is combined to a non-woven web when making the non-woven fabric. Besides, as shown in the above procedure, it is also possible to bind the woven or knitted fabric sheet made of the ultra fine fibers to the product of



which a series of artificial leather treatment including dyeing or mirror-like coating treatment has been finished.

In the present invention, various physical properties of the composite sheet for artificial leather are determined as follows.

5        Fineness (denier) of ultra fine fiber

The sample of a cross-section of the composite sheet for artificial leather is taken and a preparation process such as gold coating is applied thereto. The photograph of the surface of the composite sheet for artificial leather is taken by a scanning electron  
10        microscope. Then, the cross-sectional area of the ultra fine fibers shown on the photograph is evaluated. The cross-sectional area is obtained for each of ten strands ( $n=10$ ) of the ultra fine fibers and the average value thereof is obtained. The obtained value is converted into an actual value in consideration of the magnification of  
15        the photograph. Then, the fineness is obtained through the following formula.

$$\text{Fineness (denier)} = 9A\rho/1000$$

In this formula,  $A$  is the surface area ( $\mu\text{m}^2$ ) of the cross-section of the ultra fine fiber and  $\rho$  is the density ( $\text{g/cm}^3$ ) of the ultra fine  
20        fiber. The applied density of nylon is 1.14 and the applied density of polyethylene terephthalate is 1.38.

Here, in case that the cross-section is a circular type, the cross-sectional area  $A$  of the ultra fine fiber is obtained by the following formula by measuring the diameter of the cross-section. In

case that the cross section is non-circular type, the cross-section is directly obtained through an image analyzer and the like.

In case that the cross-section is a circular type :

$$\text{Cross-section } (\mu\text{m}^2) = \pi D^2/4$$

5     · Number of ultra fine fibers

One strand of yarn constituting the woven or knitted fabric layer(2) is taken from the prepared composite sheet for artificial leather and a preparation process such as gold coating is applied thereto. Then, the photograph of the cross-section of one strand of  
10   yarn constituting the woven or knitted fabric layer(2) is taken by a scanning electron microscope and the number of ultra fine fibers shown on the photograph is counted.

· Stitching strength

Two test pieces each having a width of 100mm and a length of  
15   100mm are prepared, respectively, in the longitudinal and transverse directions of the composite sheet for artificial leather. One end of a test piece, is overlaid on the one end of another test piece. And then sewing(\*) a folded part, which is 10mm from the ends of each test piece so as to form two groups of test pieces, respectively, in the  
20   longitudinal and transverse directions. The stitching strength is measured under the conditions of a clamp distance of 76.2mm (3 inches), a clamp size of a 20mm length and a 30mm width for both upper and lower portions and a pulling speed of 200mm/min. The measurements in the two directions are averaged and reported

herein as the "stitching strength" of the composite sheet in kg of overhang per mm of composite sheet fineness.

\* A high tenacity nylon yarn is used as the sewing yarn and the sewing distance is 4mm. Among common sewing yarns, the high tenacity nylon yarn has a high strength of about 200 denier. It must have a larger tension strength than those of the test pieces and must not change the test result. In addition, the stitches at the opposite ends have to be tightly knotted by sewing it with a sewing yarn that is cut to a slightly large length, so that it cannot be loosened.

#### 10      · Elongation at constant load

Three test pieces each having a width of 50mm and a length of 250mm are cut out from the composite sheet for artificial leather in the longitudinal and transverse directions and a standard length of 100mm is marked along their center lines. These test pieces are mounted on a fatigue tester (\*) at a clamp distance of 150mm and a 8kg load (including the load of the lower clamp) is carefully suspended on the test pieces for 10 minutes. With the load being suspended for 10 minutes, the standard length ( $l_0$ ) is obtained and the elongation at constant load is calculated by the following formula;

$$20 \quad \text{Elongation at constant load (\%)} = l_0 - 100$$

In this formula,  $l_0$  designates the standard length (mm) after suspending the load of 8kg for ten minutes. \* As the fatigue tester, 'Marlens fatigue tester' is used.

#### · Stiffness

Five test pieces, each having a 25mm width and a 200mm length, are taken out of a sample, respectively, in the longitudinal and transverse directions. The test pieces are placed on a smooth horizontal table having a 45 degree inclined surface at its pointed end and a scale at its top surface so that the shorter side of the test pieces matches the base line of the scale. Then, the test pieces are pressed by a pressing plate of the same size as the test pieces and are slid toward the inclined surface at a speed of approximately 10mm/sec, and when the one end of the test pieces contacts the inclined surface, the position of the other end of the test pieces is read by the scale. The stiffness is indicated by the moving distance (mm) of the test pieces from the base line. The stiffness is measured both for the front surface and for the backside of each test pieces, and expressed in an average obtained from the measurements made for the front surface and backside of five test pieces, respectively, in the longitudinal and transverse directions.

Surface state (appearance/color difference)

The surface state is evaluated by 10 panelists. The surface state judged by more than 8 persons to be good was designated as "◎"; the case where six or seven persons judged the surface state to be good was designated as "◇"; the case where four or five persons judged the surface state to be good was designated as "△"; and the case where three or less persons judged the fabric to be good was designated as "×".

### BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of preferred embodiments of the present invention will be more fully described in the following detailed description, taken accompanying drawings. In  
5 the drawings:

Fig. 1 is a scanning electron micrograph of a cross-section of a composite sheet for artificial leather of the present invention;

Fig. 2 is a schematic view of the cross-section of the composite  
10 sheet for artificial leather of the present invention wherein the denier of ultra fine fibers of a woven or knitted fabric layer(2) is smaller than that of ultra fine fibers of a non-woven fabric layer(1);

Fig. 3 is a schematic view of the cross-section of the composite sheet for artificial leather of the present invention wherein the denier  
15 of the ultra fine fibers of the woven or knitted fabric layer(2) is the same as that of the ultra fine fibers of the non-woven fabric layer(1); and

Fig. 4 is a schematic view of the cross-section of the composite sheet for artificial leather of the present invention wherein the denier  
20 of the ultra fine fibers of the woven or knitted fabric layer(2) is larger than that of the ultra fine fibers of the non-woven fabric layer(1).

※ Explanation of reference numerals for main parts of the drawings

1: non-woven fabric layer made of ultra fine fibers

1a: ultra fine fibers of non-woven fabric layer

2: woven or knitted fabric made of ultra fine fibers

2a: ultra fine fibers of woven or knitted fabric having a smaller  
denier than ultra fine fibers of non-woven fabric layer

5        2b: ultra fine fibers of woven or knitted fabric having the same  
denier as ultra fine fibers of non-woven fabric layer

2c: ultra fine fibers of woven or knitted fabric having a larger  
denier than ultra fine fibers of non-woven fabric layer

3: area having a combination of ultra fine fibers and  
10 polyurethane resin

#### BEST MODES FOR CARRYING OUT THE INVENTION

Hereinafter, the present invention will be described in detail  
with reference to examples, but not limited thereto.

##### 15        Example 1

A sea-island type composite continuous fiber having a fineness  
of 3 deniers convertible into a bundle of fine fibers was prepared  
from 70 by parts weight of polyethylene terephthalate as a  
fiber-forming component and 30 parts by weight of copolymer  
20 polyester as an extraction component through spinning and drawing  
processes. At this time, the monofilament of the continuous fiber has  
16 ultra fine fibers (fiber-forming component) therein. A part of the  
thusly obtained composite fiber convertible into a bundle of fine  
fibers was used to produce short fibers by cutting it out at a 40mm

length and giving a crimp. Another part thereof was used as warp and weft in producing a woven fabric which had a warp density of a 100 yarns/inch, a weft density of 80 yarns/inch and a weight of 100g/yd after twisting it in the form of continuous fibers with a total  
5 fineness of 75 deniers at 2500 twists per meter in a twisting machine. The above-mentioned short fibers formed a web by a carding-cross lapping process, and this web was combined to the woven fabric by needle-punching during the preparation of a non-woven fabric , thereby forming a composite sheet. Then, the  
10 composite sheet of the now-woven fabric layer and the woven fabric layer was padded and dried in a 10% aqueous solution of polyvinyl alcohol so as to have the amount of 10% by weight with respect to the weight of the fibers. Afterwards, the composite sheet was dipped in a 15% impregnating solution prepared by diluting a polyurethane  
15 elastomer of the polyether-polyester copolymer glycol type in dimethylformamide (DMF). Then, the polyurethane was coagulated in the aqueous solution, washed in a 70°C hydrothermal solution for removing polyvinyl alcohol polymer, and dried. The content of polyurethane after the drying step was found to be 25% by weight.  
20 The composite sheet constructed of the above-mentioned fibers and polyurethane was converted into a bundle of fine fibers by continuously treating it in a 10% aqueous solution of sodium hydroxide at 100°C for completely removing the sea component, i.e., copolymer polyester, so that only the island component, i.e., the

component of polyester fine fibers, was left. At this time, both the fibers in the non-woven fabric layer and the ultra fine fibers in the woven fabric layer had a fineness of 0.13 denier and the number of ultra fine fibers constituting the filament of woven fabric was 400.

5 Then, a part of the ultra fine fibers was cut out and raised by carrying out buffing treatment using a #240 grit sand paper in order to obtain fluffs. Next, the obtained sheet was dyed with a disperse dye having an excellent fastness in a high pressure rapid dyeing machine. Then the sheet was reduction, cleared, and dried.

10 Continuously, water repellent and antistatic agent treatment and fluff tip softening treatment were carried to thus prepare a suede-like composite sheet for artificial leather. The physical properties of the thus obtained composite sheet for artificial leather were evaluated and the result was shown in Table 2.

15

#### Examples 2 to 5

Except that the denier of ultra fine fibers of a non-woven fabric, the number of ultra fine fibers of a yarn constituting a woven fabric, the number of twists of the yarn constituting the woven fabric, and

20 the denier of ultra fine fibers of the yarn constituting the woven fabric are changed as in Table 1, a composite sheet for artificial leather was prepared in the same manner as that in EXAMPLE 1. The physical properties were evaluated and shown in Table 2.



&lt;Table 1&gt; Preparation Conditions

	Denier of ultra fine fibers in non-woven fabric (denier)	Filament of woven fabric		
		Denier of ultra fine fibers	Number of ultra fine fibers	Number of twists
Example 1	0.13	0.13	400	2,500
Example 2	0.15	0.07	900	2,000
Example 3	0.07	0.07	3,600	1,000
Example 4	0.07	0.04	900	600
Example 5	0.20	0.13	1,500	3,000

Comparative Example 1

Except that a polyester multifilament of 75 deniers/24 filaments  
 5 (monofilament denier: 3.16 denier) was used as the warp and weft of  
 a woven fabric, a composite sheet for artificial leather was prepared  
 in the same manner as that in Example 1. The physical properties  
 were evaluated and shown in Table 2.

10 Comparative Example 2

Except that a polyamide multifilament of 75 deniers/24  
 filaments (monofilament denier: 3.16 denier) was used as the warp  
 and weft of a woven fabric, a composite sheet for artificial leather  
 was prepared in the same manner as that in Example 1. The physical  
 15 properties were evaluated and shown in Table 2.

&lt;Table 2&gt; Result of Evaluation of Physical Properties

	Stitching Strength (kg/m)	Elongation at Constant Load (%)	Stiffness (mm)	Surface State (Appearance, Color Difference)
Example 1	65	3.5	49	◎
Example 2	62	4.8	42	◇
Example 3	61	7	38	◎
Example 4	48	12	27	◇
Example 5	45	2.7	58	◇
Comparative Example 1	59	5	86	×
Comparative Example 2	25	22	73	△

### INDUSTRIAL APPLICABILITY

As the composite sheet for artificial leather of the present invention include a woven or knitted fabric layer(2) composed of a yarn of ultra fine fibers having a fineness less than 0.3 denier and the ultra fine fibers of woven or knitted fabric layer(2) being entangled with the ultra fine fibers of a non-woven fabric layer(1), it is low in elongation and superior in form-stability.

Regarding the form-stability, the composite sheet for artificial leather of the present invention has an elongation at constant load of less than 20% and thus a form change is not occurred much. Additionally, the stitching strength is more than 30kg/mm and thus shows very strong and wear resistant stitching characteristics. Therefore, the composite sheet for artificial leather of the present invention is very suitable for the production of cover sheet of a car

chair and covering for furniture which require superior form-stability and stitching characteristics, and artificial leather for men's clothing which require relatively strong and highly wear resistant.

Moreover, both the fibers of the non-woven fabric layer(1)  
5 constituting the composite sheet for artificial leather of the present invention and the fibers of the woven or knitted fabric layer(2) are composed of ultra fine fibers of less than 0.3 denier, and thus are superior in softness. Regarding softness, the composite sheet for artificial leather of the present invention has a stiffness of less than  
10 80mm and thus is very soft.

Therefore, since the composite sheet for artificial leather of the present invention is excellent in both form-stability and softness, it is very useful for all kinds of leather including natural leather, artificial leather and synthetic leather as well as for cover sheet of a car chair,  
15 covering for furniture and clothing.

CLAIMS

1. A composite sheet for artificial leather with low elongation and excellent softness, comprising:

5 a non-woven fabric layer (1) made of ultra fine fibers having a fineness less than 0.3 denier;

a woven or knitted fabric layer (2) constructed from a yarn made of ultra fine fibers having a fineness less than 0.3 denier; and

polyurethane resin,

10 wherein the ultra fine fibers of the non-woven fabric layer (1) and the ultra fine fibers of the woven or knitted fabric layer (2) are entangled with each other.

2. The composite sheet of claim 1, wherein the ultra fine fibers  
15 located on the surface of the composite sheet for artificial leather are raised.

3. The composite sheet of claim 1, wherein the fineness of the ultra fine fibers of the woven or knitted fabric layer (2) is 0.01 to 0.3  
20 denier.

4. The composite sheet of claim 1, wherein the yarn constituting the woven or knitted fabric layer (2) is constructed of 200 to 10,000 ultra fine fibers.

5. The composite sheet of claim 1, wherein the total denier of the yarn constituting the woven or knitted fabric layer (2) is 30 to 150 deniers.

5

6. The composite sheet of claim 1, wherein the number of twists of the yarn constituting the woven or knitted fabric layer (2) is 500 to 700 twists/m.

10

7. The composite sheet of claim 1, wherein the number of twists of the yarn constituting the woven or knitted fabric layer (2) is 700 to 2,500 twists/m.

15

8. The composite sheet of claim 1, wherein the number of twists of the yarn constituting the woven or knitted fabric layer (2) is 2,500 to 4,000 twists/m.

20

9. The composite sheet of claim 1, wherein the yarn constituting the woven or knitted fabric layer (2) is a staple spun yarn or continuous filament yarn.

10. The composite sheet of claim 1, wherein the yarn constituting the woven or knitted fabric layer (2) is a polyester based resin or nylon based resin.

11. The composite sheet of claim 1, wherein the weight of the woven or knitted fabric layer (2) is 30 to 200g/m<sup>2</sup>.

5        12. The composite sheet of claim 1, wherein the warp and weft densities of the woven or knitted fabric layer (2) are more than 40 yarns/inch.

13. A composite sheet for artificial leather with low elongation  
10 and excellent softness, comprising:

a non-woven fabric layer (1) made of ultra fine fibers;

a woven or knitted fabric layer (2) made of ultra fine fibers;

and

polyurethane resin,

15        wherein the ultra fine fibers of the non-woven fabric layer (1) and the ultra fine fibers of the woven or knitted fabric layer (2) are entangled with each other and the fineness of the ultra fine fibers of the woven or knitted fabric layer (2) is not more than the fineness of the ultra fine fibers of the non-woven fabric layer (1).

20

14. The composite sheet of claim 13, wherein the ultra fine fibers located on the surface of the composite sheet for artificial leather are raised.

15. The composite sheet of claim 13, wherein the weight ratio of the non-woven fabric layer (1) to woven or knitted fabric layer (2) is 90:10 to 50:50.

5           16. The composite sheet of claim 13, wherein the weight ratio of the ultra fine fibers to polyurethane resin is 90:10 to 50:50.

17. A composite sheet for artificial leather with low elongation and excellent softness, comprising:

10           a non-woven fabric layer (1) made of ultra fine fibers;  
            a woven or knitted fabric layer (2) made of ultra fine fibers;  
            and  
            polyurethane resin,

            wherein the ultra fine fibers of the non-woven fabric layer (1)  
15   and the ultra fine fibers of the woven or knitted fabric layer (2) are entangled with each other and the composite sheet has a stitching strength of more than 30kg/mm, an elongation at constant load of less than 20% and a stiffness of less than 80mm.

20           18. The composite sheet of claim 17, wherein the ultra fine fibers located on the surface of the composite sheet for artificial leather are raised.

1/2

DRAWING

Fig. 1

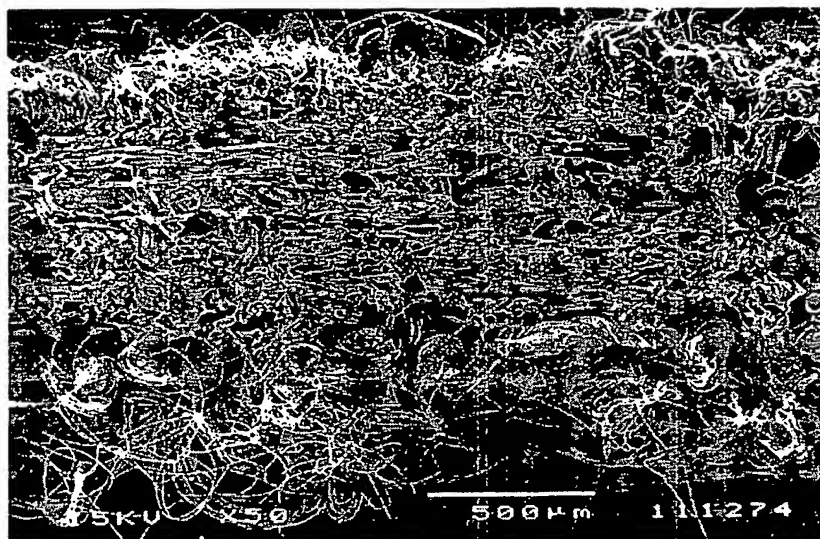


Fig. 2

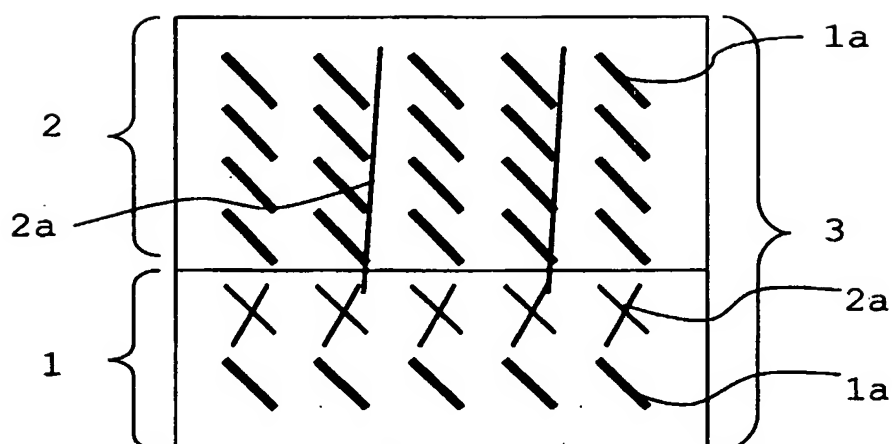




Fig. 3

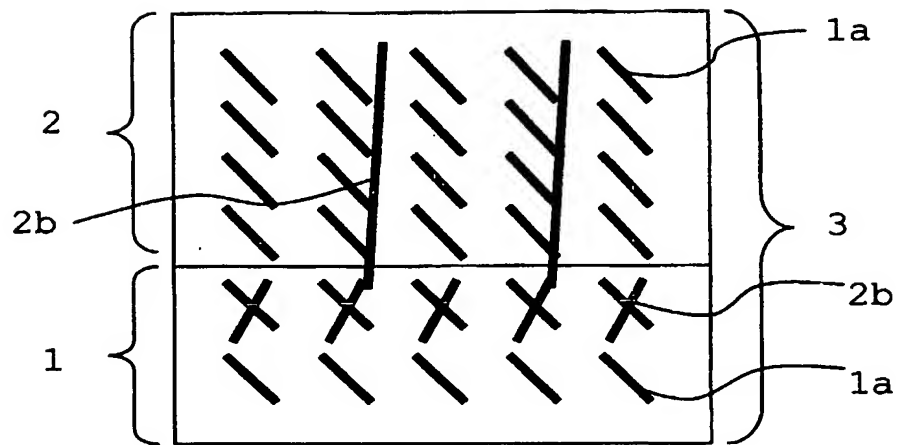
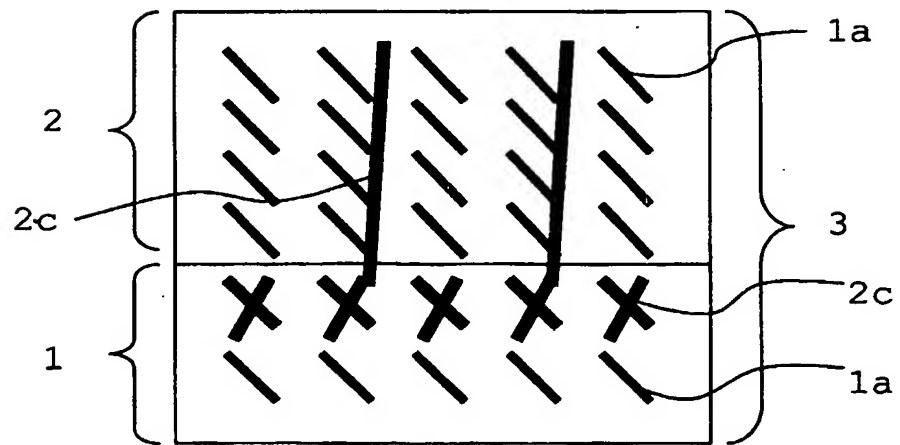


Fig. 4



## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/KR03/00204**A. CLASSIFICATION OF SUBJECT MATTER****IPC7 D06N 7/00, D06N 3/00**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC7 D06N 3/04, D04H 1/58, A43B 1/14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Patent and applications for inventions since 1975

Korean Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

KIPASS, WIPS, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2000-2000314087 A2 (KURARAY CO., LTD) 14 NOVEMBER 2000 See the whole document	1,13
A	JP 2001-2001190307 A2 (KURARAY CO., LTD) 17 JULY 2001 See the whole document	1,13
A	KR 10-140491 B2 (DONGYANGNYLON CO., LTD) 12 MARCH 1998 See the whole document	1,13
A	JP 62-78281 A (TORAY IND INC) 10 APRIL 1987 See the whole document	1,13

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

21 MAY 2003 (21.05.2003)

Date of mailing of the international search report

21 MAY 2003 (21.05.2003)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office  
920 Dunsan-dong, Seo-gu, Daejeon 302-701,  
Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

BYUN, Jong Jin

Telephone No. 82-42-481-5405



**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

PCT/KR03/00204

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2000-2000314087 A2	14.11.2000	EP 1031656 A1 CN 1264770 A KR 2000006659 A	30.08.2000 30.08.2000 26.12.2000
JP 2001-2001190307 A2	17.07.2001	EP 1114592 A3 US 20011024709 A CN 1306903 A KR 20010070444 A	04.10.2001 27.09.2001 06.02.2001 25.07.2001
KR 10-140491 B2	12.03.1998	NONE	
JP 62-78281 A	10.04.1987	NONE	

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☒ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**